Health Information Systems
Investigating Greek Hospital Employees' Intention to Use Electronic Health Records

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Abstract: This research examines the factors affecting Greek hospital employees' intention to use Electronic Health Records (EHR). The findings indicate that perceived ease of use and perceived usefulness are very significant drivers in the adoption of the EHR. Moreover, the intention to use EHR by employees is also affected by management support and subjective norms.

1 INTRODUCTION

Although, the need for innovative health information systems is a fact (Knaup et al., 2006), Greek hospitals are still on a primary stage regarding the use of Electronic Health Records (EHR) with the implementation of only minor scale EHR systems in small regions to have been completed so far (Observatory on the Information Society, 2007). This study intends to shed some light on the factors that affect Greek hospital employees' intention to use EHR. For that purpose a version of the TAM (Technology Acceptance Model), differentiated to fit the needs of computer acceptance in Greek hospitals, has been used.

2 LITERATURE REVIEW

Information Technology (IT) is considered to be the second "industrial revolution" after that of the 19th century (Sistrom, 2005). Even though it has brought about many changes in various fields, in the healthcare there has been a delay in the adoption of the IT (Ash and Bates, 2005 cited in Callen, 2007).

According to Ovretveit et al. (2007), despite the fact that many countries and health service providers have established policies for the implementation of health information systems and Electronic Medical Records (EMR), there is still a large distance to be covered from theory (policy) to practice. A collection of various types and definitions of HER is provided by Hayrinen et al, 2008, p. 295.

2.1 Paper Records vs Electronics Health Records

Even though EMRs have been implemented in many hospitals around the globe, still, personnel such as doctors and nurses, continue to take handwritten notes for the observation and treatment of the patient, writing prescriptions and radiology orders (Atreja et al., 2008).

It is true that the majority of Hospital personnel find it easier and more time saving them using a computerized system during the clinical sessions. Another important reason for the supporters of paper-based records is their durability as well as their accessibility by sight. However, there are also many negative aspects regarding the paper records. Most of the patient's records that are kept in paper usually "stay" within the healthcare facility.

On the other hand the implementation and use of an EHR in health care institutions, helps staff reduce the time spent for many actions of their daily routine (Hier, 2005). This could include the retrieval of a patient's data and history, immediate access to his laboratory or other exams needed and the entry of new medical data during his treatment inside the facility.

As Bakker (2007) points out, the fundamental difference between the electronic systems and the commonly used paper records is the field of security. Not only EHRs offer different levels of authorization

to their multiple users, but also, it is possible to know which user had access to where and when through the electronic trails of the system.

2.2 Global Efforts for EHR Implementation

EHR have been developed by countries such as UK (Atlantis and Vidavo, 2007), Australia (Thompson and Brailer, 2004), Canada (Sherman, 2001). Finland (Trade Partners, 2002) and Germany (Cross, 2000) where a similar system, based on the smart card technology, is in use.

In the United States a decision has been made (in 2003) to have an EHR system by 2013 (Medicare Prescription Drug Improvement and Modernization Act MMA), estimating that 90% of the physicians and 70% of the hospitals will be "meaningful users" by 2019. Also Canada, aims to meet its target of delivering EHR to 100% of all Canadians by 2015 (Shaw, 2010).

Further, in Australia the HealthConnect program was initiated in 2001 and it was separated into three stages (HealthConnect, 2004), with the aim to cover 80% of Queensland Health activity by 2012.

The European Commission (EC) has been funding research activities concerning the use of Information and Computer Technology (ICT) in the Health Sector for the last two decades (European Commission Information Society, 2010).Greece is a country with a very different Healthcare infrastructure compared to other developed countries (Orfanidis et al., 2004).

The initial attempt for the introduction and use of ICT in the Health sector in Greece started with the Integrated Mediterranean Programs and Community Support Framework (CSF) I (1986 – 1993), and was continued in the CSF II (1994-1999), CSF III (2000-2006) and CSF IV (2007-2013).

2.3 Technology Acceptance Model

Technology Acceptance Model (TAM) (first introduced by Davis, 1986) best describes IS usage and IS acceptance behaviors (Dasgupta et al., 2002, Holden and Karsh, 2008).

In this model, "attitude" and "intention" are influenced by "Perceived usefulness" and "Perceived ease of use" (for definitions look at Davis, 1985 p.320 and Holden and Karsh, 2008, who have used TAM to study the adoption of health IT). Their findings support the high predictive power of TAM concerning the use and the acceptance of health IT though with the need of some "add-ons".

Apart from the standard features of the TAM model, Holden and Karsh (2008) suggest the use of some more parameters such as system quality, and standardization. Moreover, they found strong evidence that perceived ease of use will result in greater acceptance and use of IT health systems by clinicians. On the other hand, ease of use may not affect acceptance in a great extent but appears to correlate with usefulness. Finally, it is stated that no matter how useful and easy to use a health IT is, effort is needed to ensure that clinicians will be able to use it (self-efficacy), that using the system will be under their control (controllability) and they will be provided with every kind of support (facilitating conditions).

Aggelidis and Chatzoglou (2007), used a modified TAM to study the acceptance of health information systems (HIS) by Greek hospital personnel. Their findings point out that personnel's behavioral intention to use HIS is positively affected by perceived usefulness, ease of use of the system, social influence, attitude, facilitating conditions and self-efficacy. Moreover, an indirect relationship among training and behavioral intention was detected. Finally, positive effects between social influence and self-efficacy, perceived usefulness and anxiety, facilitating conditions and social influence were supported by the results.

3 RESEARCH FRAMEWORK AND METHODOLOGY

To achieve the main targets of this research a new conceptual framework has been developed based on the work of Aggelides and Chatzoglou (2007) and Chatzoglou et al. (2008). This framework (figure 1) is adequate to measure intention to use EHR since it is a version of TAM, and part of it has already been tested in Greek companies.

3.1 Hypotheses Development

In order to test the model, a number of hypotheses are developed, based on the technology acceptance model, which is altered in such a way to fit the needs of this research.

Primarily, the intention to use the electronic patient records is, according to Chatzoglou et al (2008), positively affected by perceived ease of use and perceived usefulness. It is logical, therefore, to claim that the friendlier and easier it is for an employee to use a system in general, and the EHR in specific, the higher the chances he/she is going to

use it. Similarly, it is normal to assume that the more useful an IT system is to employees for assisting them to complete their daily tasks, the higher the chances that they will be using it.
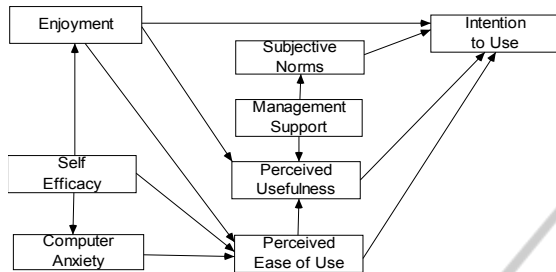

Figure1: The proposed model.

Finally, it also make sense to assume that perceived usefulness and perceived ease of use are closely related to one another. The ease of using an IT system enhances users' perception of its usefulness.

H.1 The intention to use electronic health records is positively affected by perceived ease of use.

H.2 The intention to use electronic health records is positively affected by perceived usefulness.

H.3 Perceived usefulness of electronic health records is positively associated with perceived ease of use.

Next, it is well documented that, under specific circumstances, management support motivate hospital employees to look at a new system from a different, more positive, angle. According to literature (Karahanna et al., 1999), management support could be considered as an extension of the original TAM. It was also proven that organizations lacking management support would not easily persuade their employees to use the technology required for the case (Venkatesh et al., 2003).

H.4 There is a positive relationship between Management support and perceived usefulness

H.5 There is a positive relationship between Management support and perceived ease of use

Further, it is suggested that the more nervous someone feels towards using computers, the lower the chances for him/her to understand its usefulness.

H.6 Computer anxiety has a negative impact on perceived usefulness

H.7 Computer anxiety has a negative impact on perceived ease of use.

Computer self-efficacy is also a key factor influencing intention to use EHR. It is assumed that if an employee is a computer expert, he will probably be much more interested in getting to know the new system.

H.8 Self efficacy has a positive impact on perceived usefulness.

H.9 Self efficacy has a positive impact on perceived ease of use.

H.10 Self efficacy has a negative impact on computer anxiety.

Another crucial factor affecting intention to use an IT system is enjoyment. It has been statistically proven that the more a person enjoys using computers, the more willing he/she would be to learn new things, especially if it has to do with their professional occupation. Scholars also believe that there is a positive association between enjoyment and perceived usefulness (Davis et al., 1992; Venkatesh et al., 2002), as well as between enjoyment and perceived ease of use (Moon and Kim, 2001; Venkatesh, 1999, 2000; Yi and Hwang, 2003). These findings also apply in the case of EHR. Finally, the more a person enjoys using these EHR, the more confident he becomes. Previous research (Offodile and Abdel-Malek, 2002) has shown that the attitude towards computers in general can play a key role in whether to adopt new technologies within the working environment..

H.11 Enjoyment of using and intention to use EHR are positively associated.

H.12 Enjoyment of using and perceived usefulness of EHR are positively associated.

H.13 Enjoyment of using and perceived ease of use of EHR are positively associated.

H.14 Enjoyment of using electronic health records and self-efficacy are positively associated.

Finally, another factor that may affect intention to use EHR is subjective social norms. Social subjective norms reflect the influence of important people on a person as far as the use of EHR is concerned. The importance of this factor is highlighted in previous literature (Taylor and Todd, 1995; Venkatesh and Davis, 2000; Venkatesh et al., 2003; Yu et al., 2005).

H.15 Top Management positively influences a person's subjective social norms about using electronic health records.

H.16 Social subjective norms positively influence the intention to use electronic health records.

3.2 Data Collection Process and Sample Characteristics

The research instrument used to collect data is a structured questionnaire divided into eight sections. The first section included general questions referred to each participant and his/her organization, while the other seven sections referred to each of the construct included in the proposed research model. The second section of the questionnaire measured the intention to use the EHR and is based on the TAM (Yu et al., 2005; Premkumar and Bhattacherjee, 2008). All items used are measured on a 7 point Likert scale.

Questionnaires were distributed to 10 Greek hospitals from where 437 usable questionnaires was received. Apart from the questionnaires,a small number of interviews were held in every hospital with people in key positions (manager of the IT department, director of the administrative personnel, Head of nursing staff and Leader of the medical staff).

All respondents were health staff in these hospitals and their average age were the 38 years.

4 RESULTS

Initially, since the items used were adopted by other similar researches, a confirmatory factor analysis is performed to test the validity of the scales used.

4.1 Reliability Analysis

The Cronbach's alpha is adopted for measuring the reliability of each factor. As seen in Table 1, all Cronbach's alpha measurements are above the critical value of 0.5, which show that the reliability of all factors is high.

Table 1: Reliability and Factor Analysis.

	Items	Crombach'sα	KMO	Bartlett's	Construct reliability	Variance extracted
Computer anxiety	4	0,888	0,82	0,000	0,87	64,17%
Enjoyment	3	0,923	0,73	0,000	0,79	58,31%
Intention to use	5	0,895	0,80	0,000	0,80	58,76%
Management Support	3	0,871	0,74	0,000	0,84	64,03%
Perceived ease of use	4	0,908	0,75	0,000	0,83	61,82%
Perceived usefulness	4	0,816	0,74	0,000	0,81	59,88%
Self efficacy	10	0,961	0,94	0,000	0,88	64,88%
Subjective norms	11	0,958	0,93	0,000	0,94	70,70%

4.2 Factor Analysis

Other aspects that should be taken into account are the values of KMO and the Bartlett's test of sphericity Table 4.1presents the results drawn from this analysis (Kaiser-Meyer-Olkin measure of sampling adequacy).

The results of the test for the KMO and the Bartlett's test show that the indices are greater than the acceptance levels (KMO>0.5 while the Sig<0.05).

Another important aspect in the factor analysis is the construct reliability and the variance extracted. It can be noticed that construct reliability for all objects exceeds the critical value of 0.7, i.e. while for all factors the variance extracted values are all above 50%, indicates that the latent variables explain the determination variables at an adequate level.

Further, Table 2 presents the goodness of fit statistics for every factor. The results are above the desired level for all CFI, GFI and AGFI, while the values of RMR and RMSEA are all below the level of 0.1, and the ratio of chi square/df is also below the accepted threshold (5). These results indicate that the factors show good fit for the SEM analysis.

Table 2: Goodness of fit statistics for every factor.

	CFI	GFI	AGFI	RMSEA	RMR	Chi Sq.	df
Computer anxiety (CA)	0.94	0.91	0.93	0.033	0.037	9.04	6
Enjoyment(EN)	0.93	0.91	0.94	0.017	0.021	4.42	2
Intention to use (IU)	0.92	0.88	0.91	0.074	0.042	9.53	4
Management Support (MS)	0.92	0.95	0.93	0.065	0.022	17.64	5
Perceived ease of use (PEU)	0.97	0.91	0.93	0.055	0.037	8.44	3
Perceived usefulness(PU)	0.93	0.89	0.92	0.029	0.018	8.72	5
Self efficacy(SE)	0.95	096	0.93	0.017	0.010	12.41	9
Subjective norms(SN)	0.93	0.95	0.95	0.015	0.044	343.00	115

4.3 Evaluation of the Structural Models

Figure 2 presents the results of the Structural Equation Modeling analysis while table 3 shows the goodness of fit statistics of the proposed model. It is worthwhile noticing that all the fit indices (CFI, GFI, AGFI) are all above the desired value of 0.9, and as the RMSEA and RMR values are below the critical limit of 0.1.

Table 3: Overall Model fit.

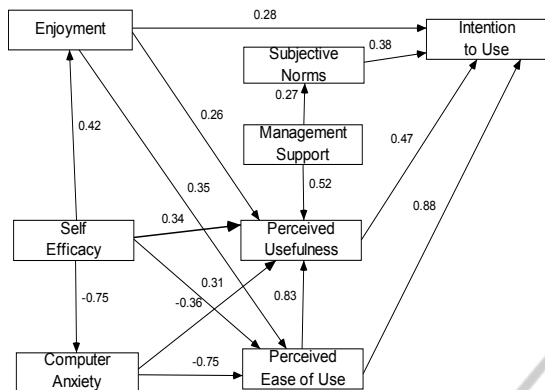|	CFI	GFI	AGFI	RMSEA	RMR	Chi Sq.	df
Computer anxiety	0.92	0.91	0.93	0.078	0.068	332.45	221

Figure 2: Final structural model.

The results of the research indicate that perceived ease of use (.88) plays a more important role in the adoption of EHR than perceived usefulness (.47). These findings imply that if EHR incorporates various features and technical characteristics which make its use easy then not only users' will be motivated to use it but also will affect their perception about the usefulness of the system. In addition, findings imply that perceived ease of use affect perceived usefulness. Thus, top management should focus on software that is simple and easy to use, in order to enhance staff performance and productivity.

Moreover, the results indicate a strong relationship between management support and perceived ease of use and a less strong but significant relationship with perceived usefulness.

Another strong relationship found between intention to use EHR and social subjective norms. It makes sense to say that in a working environment, social relationships are evolved. People that care for one another would give an advice to use the specific software in order for their colleagues to achieve better results at work.

Computer anxiety also plays an important role in the acceptance of the EHR in hospitals. All three hypotheses concerning the negative relationship between computer anxiety and perceived ease of use, perceived usefulness and self-efficacy are confirmed. Top management should consider fighting this phenomenon, since it is holding back the progress of the hospital. This can be also proven by the confirmation of the hypotheses regarding the skills of each and every employee and perceived usefulness and ease of use of the EHR.

Another key finding of this research is that enjoyment is strongly related to intention to use, perceived usefulness and perceived ease of use. It is clear that once employees enjoy using computers in

their jobs, will be more determined to use EHR, even if they have not used similar software in the past.

5 CONCLUSIONS AND LIMITATIONS

This research has focused on measuring the intention to use EHR Greek hospital employees, designing and empirically testing a new conceptual framework (research model), which is an integrated version of the initial technology accepted model (TAM).

Results show that intention to use the EHR is a function of many factors which are interconnected to one another. People intend to use EHR once they are persuaded that these systems are easy to use and very useful for their daily working life.

Although the sample of respondents is rather large, the results cannot be generalized, since most of these hospitals are using different (bespoke) systems.

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